

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 26 JUL 2006

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Applicant's or agent's file reference 0213828589	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
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Applicant STRARCH TECHNOLOGIES PTY LTD et al			

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a.  (*sent to the applicant and to the International Bureau*) a total of 11 sheets, as follows:

sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b.  (*sent to the International Bureau only*) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/> Box No. I	Basis of the report
<input type="checkbox"/> Box No. II	Priority
<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/> Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/> Box No. VI	Certain documents cited
<input type="checkbox"/> Box No. VII	Certain defects in the international application
<input type="checkbox"/> Box No. VIII	Certain observations on the international application

Date of submission of the demand 31 January 2006	Date of completion of this report 14 July 2006
Name and mailing address of the IPEA/AU  AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer  <b>JOHN HO</b> Telephone No. (02) 6283 2329

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2005/000463

## Box No. I Basis of the report

1. With regard to the language, this report is based on:

The international application in the language in which it was filed

A translation of the international application into , which is the language of a translation furnished for the purposes of:

- international search (under Rules 12.3(a) and 23.1 (b))
- publication of the international application (under Rule 12.4(a))
- international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

the international application as originally filed/furnished

the description: pages 5, 7-11 as originally filed/furnished  
pages\* 1-3a, 4, 6-6a received by this Authority on 31 January 2006 with the letter of 31 January 2006

the claims: pages as originally filed/furnished  
pages\* received by this Authority on with the letter of  
pages\* as amended (together with any statement) under Article 19  
pages\* 12- 14 received by this Authority on 31 January 2006 with the letter of 31 January 2006  
pages\* received by this Authority on with the letter of

the drawings: pages 1/13-9/13, 11/13-13/13 as originally filed/furnished  
pages\* 10/13 received by this Authority on 31 January 2006 with the letter of 31 January 2006  
pages\* received by this Authority on with the letter of

a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3.  The amendments have resulted in the cancellation of:

- the description, pages
- the claims, Nos.
- the drawings, sheets/figs
- the sequence listing (*specify*):
- any table(s) related to the sequence listing (*specify*):

4.  This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- the description, pages
- the claims, Nos.
- the drawings, sheets/figs
- the sequence listing (*specify*):
- any table(s) related to the sequence listing (*specify*):

\* If item 4 applies, some or all of those sheets may be marked "superseded."

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2005/000463

**Box No. V** **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

## 1. Statement

Novelty (N)	Claims <b>2-8, 18, 20-22 and 28</b>	YES
	Claims <b>1, 9-17, 19, 23-27</b>	NO
Inventive step (IS)	Claims <b>2-3</b>	YES
	Claims <b>1, 4-28</b>	NO
Industrial applicability (IA)	Claims <b>1-28</b>	YES
	Claims <b>-</b>	NO

## 2. Citations and explanations (Rule 70.7)

The following documents identified in the International Search Report have been considered for the purposes of this report:

D1 – GB 2167783  
 D2 – WO 1996/001930  
 D3 – US 3940892  
 D4 – GB 1355984  
 D6 – WO 1992/018730  
 D7 – US 4894962  
 D8 – WO 1995/020079  
 D9 – DD 289081  
 D10 – US 3857213  
 D11 – WO 2003/078739

**NOVELTY (N): Claims 1, 9-17, 19, 23-27**

The invention defined by the present claim 1 disclosed by each of D7-D11.

Specifically, D7 discloses a structure (10) formed from a plurality of components (11). Each component (11) is formed from a beam (12) and a pair of end fixtures (13, 14). The conditioning element in this instance is the cable (30). D7 also discloses the use of *frusto-pie shaped inserts* (55) held between each of the fixtures to provide for “*changes in the structural configuration requiring greater angles at the ends of the fixtures...*” (see column 5 lines 12-22). These inserts can be considered to be a disclosure for the packing elements.

D7 clearly discloses the invention defined by claims 1, 9-17, 19, 23-27.

D8 discloses a structure member formed from a plurality of support means (12). D8 also discloses “*conditioning means*” (see pull means 14 in figure 2 for instance) and packer elements in the form of intermediary parts (13) for shaping or re-configuring the shape of the structural elements. D8 discloses the invention defined by claims 1, 9-17, 19, 23-27.

D9 discloses the use of one or more packer elements. See for instance; item 1” in figure 6. D9 discloses the invention defined by claims 1, 9-17, 19, 23-27.

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of: Box V

D10 also discloses the use of at least one or more packer elements (see item 33 in figures 7-28) for use in a structure formed from a plurality of modules and one or more conditioning elements (see flexible strand (1) for instance). D10 discloses the invention defined by claims 1, 13-17, 19, 23-27.

D11 discloses a structure formed from modules (see items 10, 10'), conditioning elements (refer to the nuts and bolts in page 10, the pre-formed surfaces (31) or the stiffened framework (71) for instance) and packer elements (see item 61, 62 in figures 6a and 6b, and claim 10 for instance). D11 discloses the invention defined by claims 1, 9-17, 19, 23-27.

**INVENTIVE STEP (IS): Claims 1, 4-28**

Claims 1, 9-17, 19, 23-27 also lack an inventive step for the reasons given above.

Citations D1-D4 and D6: Each of these citations discloses the use of a plurality of trapezoidal truss modules to from a structure. Each of these citations also discloses the use of truss modules having upper and lower chords, diagonal web members, and tensioning tendons or cables. Whilst these citations do not disclose the use of packing elements adapted to be located between adjacent modules for reconfiguring the structure, the use of packing elements in a structure formed from a plurality of modular elements are well known to a person skilled in the art (see citations D7-D11 for instance) and its inclusion in the claims cannot be considered to confer an inventive step.

It is also noted that whilst some of the modules are not formed from a fibre composite or a fibre reinforced polymer material, the substitution of one material for another well known material does not confer an inventive step to the invention.

For these reasons, the invention defined by claims 1, 4-28 lacks an inventive step in light of each of citations D1-D4 and D6 when read in light of the common general knowledge, or when combined with the teachings of citations D7-D11.

**INDUSTRIAL APPLICABILITY (IA): Claims 1-28**

The claims are related to products capable of commercial application.

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## MODULAR STRUCTURE

### FIELD OF THE INVENTION

The present invention relates broadly to a constructional module and a structure including a plurality of constructional modules. The invention further relates generally to a method 5 of construction and relates particularly, though not exclusively, to a method of building construction including roof truss construction.

### BACKGROUND OF THE INVENTION

Buildings that can be deployed quickly and efficiently are commonly required for example in military use. Such temporary structures are typically used in establishing a base camp 10 and include buildings for accommodation, workshops, control facilities, amenities and as equipment stores. Further, some buildings are required to have large clear spans in the order of 20m or more to house for example major equipment such as aircraft, and vehicles. As the structures often are located in remote areas and need to be assembled in hostile 15 conditions, there is a continuing need to provide such redeployable structures that can be erected and disassembled more effectively.

Improvements in material technology and construction methodology have allowed large redeployable structures to be transported and erected. Newer technologies such as air-supported structures have evolved but require mechanical equipment, pumps, fuel etc to maintain and are understood not to be well regarded for expeditionary type roles. For 20 larger structures suitable for heavy machinery, aircraft and the like, tent-like solutions do not scale particularly well.

### SUMMARY OF THE INVENTION

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According to one aspect of the present invention there is provided a structure comprising:  
a plurality of constructional modules being of a predetermined configuration;  
one or more conditioning elements being arranged to cooperate with the  
constructional modules wherein adjacent of said modules engage one another to form the  
5 structure; and

one or more packer elements being adapted to locate between adjacent of the  
constructional modules to effect reconfiguration of the structure.

Preferably the conditional elements include an upper tendon and a lower tendon being  
arranged to cooperate with an upper chord member and a lower chord member,

10 respectively, of each of the constructional modules. More preferably the tendons are  
designed to locate within the hollow section of the lower and upper chord members and  
stressing of the tendons involves pre-stressing or post tensioning of the tendons and the  
corresponding chord member.

Preferably the constructional module is shaped in the form of a trapezium including upper  
15 and lower substantially parallel chord members being interconnected at opposite ends with  
respective web members. More preferably each of the constructional modules is of a  
substantially identical shape. Even more preferably the chord and web members are  
formed as hollow section members, for example square hollow section (SHS) members.

Still more preferably the trapezium-shaped constructional module includes a pair of  
20 diagonal web members arranged to add rigidity to the module.

Preferably the constructional module includes interlocking means being arranged to  
provide interlocking of the adjacent modules. More preferably the interlocking means  
includes an integral spigot being adapted to engage a hole of an adjacent module, or *vice  
versa*, and designed to permit pivotal movement between adjacent of said modules on

deployment of the conditioning elements. Even more preferably the spigot or hole allows a hinged action between said adjacent modules. Still more preferably the spigot and/or hole together with the surrounding portion of the constructional module is reinforced. Alternatively the interlocking means at top chord level includes a pivotal or hinged 5 connector such as a clevis/pin type arrangement.

Preferably the constructional module is of a composite construction. More preferably the composite constructional module is fabricated from a fibre composite material such as a particulate filled resin material with high strengths fibre reinforcement, or a polyester resin based material. Alternately the constructional module is formed from a polymeric material 10 and may, for example, be pultruded.

Preferably the structure is a building structure, and in particular a roof truss. More preferably each of the constructional modules is a truss module.

Preferably the roof truss is clad with elongate and transversely oriented sheeting. More 15 preferably the sheeting is of a channel section and fabricated of a rigid material including a plastic such as PVC or ABS, or metallic material. Alternately the cladding is made from a fabric such as canvas.

Preferably the structure is redeployable.

According to a further aspect of the invention there is provided a method of construction, said method including the steps of:

20 providing a plurality of constructional modules each being of a predetermined configuration, one or more conditioning elements being arranged to cooperate with said modules, and one or more packer elements being adapted to locate between adjacent of the constructional modules;

locating the modules adjacent one another and positioning the conditioning 25 elements to permit engagement of said adjacent modules;

deploying the conditioning elements wherein the modules are together configured to form a structure, the packer elements being arranged to effect reconfiguration of the structure.

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Preferably the reconfiguration step is effected prior to deployment of the conditioning elements.

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Preferably the conditioning elements are each in the form of tendons and the step of deploying the conditioning elements involves stressing of the tendons. More preferably this involves pre-stressing or post tensioning of the tendons which effects deployment of the structure. Even more preferably the structure is a roof truss and stressing of the  
5 tendons provides erection of the roof truss.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

In order to achieve a better understanding of the nature of the present invention a preferred embodiment of a constructional module and a corresponding structure including a plurality of constructional modules together with a method of construction will now be described in  
10 some detail, by way of example only, with reference to the accompanying drawings in which:

**Figure 1** is a perspective view of a roof structure constructed in accordance with an embodiment of the invention;

**Figures 2A to 2F** show in front elevation a structure, or in this embodiment modular  
15 frame, including a plurality of constructional modules which in the case of figure 2B is taken from the roof structure of figure 1 whereas figures 2A, and 2C to 2F depict different sizes of the modular frame;

**Figure 3A** illustrates in side elevation and part enlarged sectional view one of the constructional modules of the preceding figures;

**Figures 3B** shows various cross-sectional views of alternate constructional modules;

**Figure 4** shows an elevational view of adjacent constructional modules and details pertaining to upper and lower interlocking connection between adjacent modules;

**Figures 5A to 5C** schematically illustrate sequential erection of the roof truss of for example figure 2B;

**Figure 6** shows in elevational and enlarged part perspective view cladding of for example the roof structure of figure 1; and

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An alternate technique is for the truss panels such as 16A or other constructional modules to be "pultruded" from a composite material. In this alternate example the module is fabricated from separate sections, each pultruded from a composite material and fixed together.

5 As shown in figures 2A to 2F the truss panels such as 16A and 16B of this embodiment are of the predetermined trapezium configuration so that on engagement, or in this case abutment, with one another they together form the building structure or module frame such as 12A. In the examples of figures 2A to 2F the modular frame such as 12A is configurable depending on the number and relative positions of the truss panels such as

10 16A and 16B or other constructional modules. In this embodiment the structure or modular frame such as 12A includes packer elements (not illustrated) located between adjacent truss panels such as 16A and 16B to adapt the modular frame such as 12A for different span, height and pitched roof structures 10. The packer elements are designed to locate in the space between adjacent lower chord members such as 20 of adjacent truss

15 panels such as 16A and 16B to adjust the spacing between modules or panels 16A/B and hence the geometry of the modular frame 12A.

The structure or modular frame 12A of this example also includes conditioning elements arranged to cooperate with the constructional modules or truss panels such as 16A and 16B to form the modular frame 12A. In this case the conditioning elements include tendons which locate within the hollow section of the upper and/or lower chord member 18 or 20 of adjacent and abutting truss panels such as 16A and 16B. This is best illustrated in figure 4 where the conditioning element or lower tendon 28 passes through adjacent lower chord members 20A and 20B of adjacent and abutting truss panels 16A to 16C. This illustration also shows an exemplary packer element 29 to be located between adjacent of the truss

25 panels such as 16A and corresponding lower chords 20A and 20B. As will later be described in more detail, the conditioning means or lower tendon 28 is deployed or in this example stressed or tensioned to facilitate cooperative movement of the truss panels such as 16A and 16B and as such erection of the modular frame 12A.

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The adjacent constructional modules or truss panels 16A and 16B each include interlocking means arranged to provide interlocking of the panels 16A and 16B when in this example they are in abutting engagement. The interlocking means in this construction of the constructional modules includes a protrusion or integral spigot such as 30A and 30B located at adjacent ends of the upper and lower chord members 18 and 20, respectively.

## Claims

1. A structure comprising:
  - a plurality of constructional modules being of a predetermined configuration;
  - one or more conditioning elements being arranged to cooperate with the

5 constructional modules wherein adjacent of said modules engage one another to form the structure; and

  - one or more packer elements being adapted to locate between adjacent of the constructional modules to effect reconfiguration of the structure.
2. A structure as defined in claim 1 wherein the conditioning elements include an upper tendon and a lower tendon being arranged to cooperate with an upper chord member and a lower chord member, respectively, of each of the constructional modules.
3. A structure as defined in claim 2 wherein the respective tendons are designed to locate within a hollow section of the lower and upper chord members and stressing of the tendons involves pre-stressing or post tensioning of the tendons and the corresponding chord member.
4. A structure as defined in any one of the preceding claims wherein the constructional module is shaped in the form of a trapezium including the upper and lower chord members being substantially parallel and interconnected at opposite ends with respective web members.
- 20 5. A structure as defined in claim 4 wherein each of the constructional modules is of a substantially identical shape.
6. A structure as defined in either of claims 4 or 5 wherein the chord and web members are formed as hollow section members.
7. A structure as defined in claim 6 wherein the hollow section members are square hollow section (SHS) members.
- 25 8. A structure as defined in any one of claims 4 to 7 wherein the trapezium-shaped constructional module includes a pair of diagonal web members arranged to add rigidity to the module.

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9. A structure as defined in any one of the preceding claims wherein the constructional module includes interlocking means being arranged to provide interlocking of the adjacent modules.

10. A structure as defined in claim 9 wherein the interlocking means includes an integral spigot being adapted to engage a hole of an adjacent module, or *vice versa*, and designed to permit pivotal movement between adjacent of said modules.

11. A structure as defined in claim 10 wherein the spigot or hole allows a hinged action between said adjacent modules.

12. A constructional module or a structure as defined in either of claims 10 or 11 wherein the spigot and/or hole together with the surrounding portion of the constructional module is reinforced.

13. A structure as defined in any one of the preceding claims wherein the constructional modules are of a composite construction.

14. A structure as defined in claim 13 wherein the composite constructional modules are fabricated from a fibre composite material.

15. A structure as defined in claim 14 wherein the fibre composite material is a particulate filled resin material with high strengths fibre reinforcement, or a polyester resin based material.

16. A constructional module or a structure as defined in any one of the claims 1 to 12 wherein the constructional module is formed from a polymeric material.

17. A constructional module or a structure as defined in claim 16 wherein the polymeric material is pultruded.

18. A structure as defined in any one of the preceding claims wherein each of the constructional modules is a truss module.

25 19. A structure as defined in any one of the preceding claims wherein the structure is a building structure.

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20. A structure as defined in claim 19 wherein the building structure is a roof truss clad with elongate and transversely oriented sheeting.
21. A structure as defined in claim 20 wherein the sheeting is of a channel section and fabricated of a rigid material.
- 5 22. A structure as defined in claim 20 wherein the cladding is made from a fabric.
23. A structure as defined in any one of the preceding claims wherein the structure is redeployable.
24. A method of construction, said method including the steps of:
  - providing a plurality of constructional modules each being of a predetermined configuration, one or more conditioning elements being arranged to cooperate with said modules, and one or more packer elements being adapted to locate between adjacent of the constructional modules;
  - locating the modules adjacent one another and positioning the conditioning elements to permit engagement of said adjacent modules;
- 10 15 deploying the conditioning elements wherein the modules are together configured to form a structure, the packer elements being arranged to effect reconfiguration of the structure.
25. A method as defined in claim 24 wherein the reconfiguration step is effected prior to deployment of the conditioning elements.
- 20 26. A method as defined in either of claims 24 or 25 wherein the conditioning elements are each in the form of tendons and the step of deploying the conditioning elements involves stressing of the tendons.
27. A method as defined in claim 26 wherein stressing of the tendons involves pre-stressing or post tensioning of the tendons which effects deployment of the structure.
- 25 28. A method as defined in either of claims 26 or 27 wherein the structure is a roof truss and stressing of the tendons provides erection of the roof truss.

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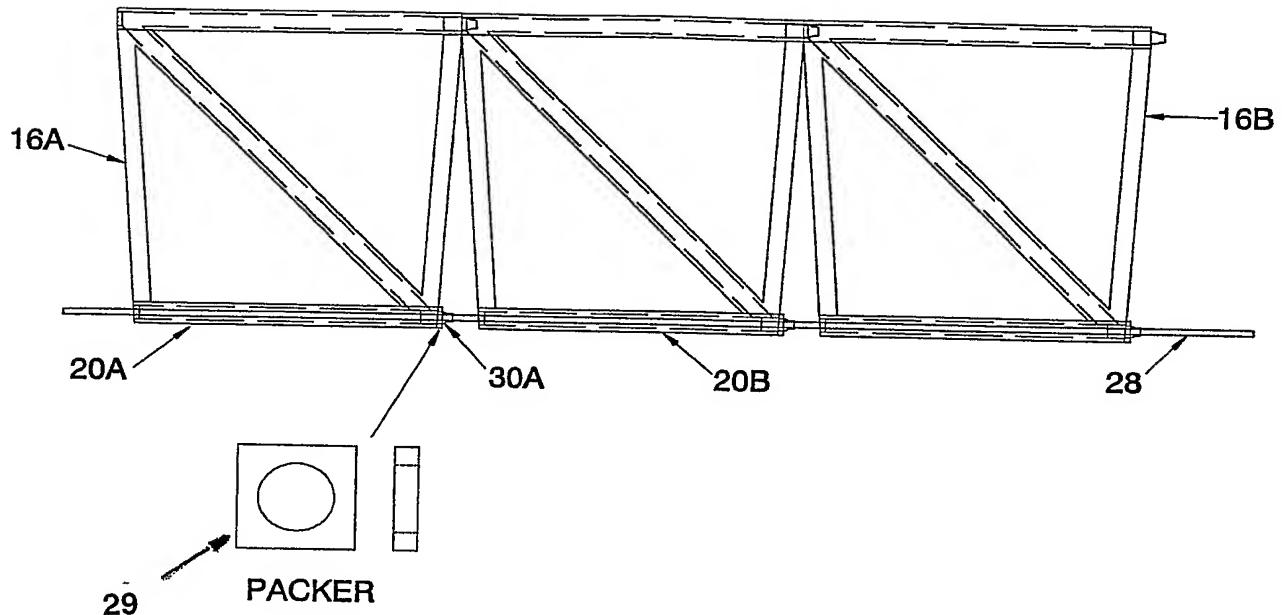


FIGURE 4